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ANDREW C. LAWSON, Editor

A NOTE ON THE  
FAUNA OF THE LOWER MIOCENE  
IN CALIFORNIA

BY

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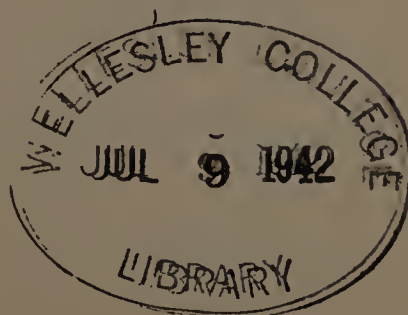
A NOTE ON THE  
FAUNA OF THE LOWER MIOCENE  
IN CALIFORNIA

BY  
JOHN C. MERRIAM

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In nearly all typical sections of the Californian Miocene it is possible to distinguish at least two divisions of the system based on the geological range of faunas. At least three faunal zones can be recognized in Contra Costa County, if we include the variation in fauna due to change in the character of the sea bottom during the deposition of the Monterey shale. This does not mean that there are only two divisions possible, or that the two mentioned are the same two in different sections, but rather that we are certainly dealing with more than one distinct zone.

One of the most characteristic phases of the Miocene in California is the Monterey shale. The fauna of this formation, as we know it, is limited to foraminifera, radiolaria, fish, cetaceans, a crustacean and a few mollusca. Among the last, *Pecten peckhami*, the indefinite *Tellina congesta* and a *Leda* are the most common forms. The fauna belongs to a deep water facies and must not be confused with the faunas of sandy, shallow water deposits. At many places where sandstone is interstratified with the shales a very sudden change of the fauna is noticed, nearly all of the typical shale species dropping out but reappearing in shaly layers above.



In addition to the shale fauna, there are in Contra Costa County two faunal zones in the Miocene, one above and one below the shale. The upper division has its nearest affinities with the San Pablo, from which it can be distinguished by the presence of *Clypeaster* (?) *brewerianus*, *Trochita costellata*, several new species of *Modiola*, and other forms.

The fauna of the lower division is much more characteristic than the upper: that is to say, it differs more decidedly from that of the beds immediately above and below it. This fauna includes the following forms:

*Agasoma grvida* Gabb.  
*Chrysodomus* n. sp.  
*Ficula* n. sp.  
*Olivella pedroana* Conrad.  
*Neverita* near *callosa* Gabb.  
*Turritella* indet.  
*Crepidula* indet.  
*Dosinia mathewsoni* Gabb.  
*Chione mathewsoni* Gabb.  
*Mytilus mathewsoni* Gabb.  
*Venus* n. sp.  
*Glycimeris* near *generosa* Gould.  
*Leda taphria* Dall.  
*Nucula divaricata* Hinds.  
*Arca* n. sp.

The most characteristic species are *Agasoma grvida*, *Dosinia mathewsoni*, *Chione mathewsoni*, and *Mytilus mathewsoni*. These beds rest upon the Tejon, which is very fossiliferous only a few yards below the contact. A large percentage of the species in this horizon do not appear in the upper Miocene and as yet not a single species has been found to extend down into the Tejon. In Contra Costa County the fauna of this zone is more distinctive as that of the Monterey shale, considering even that the latter represents a deep water facies.

The lower fauna is recognized at many places in Contra Costa County, and always next the base of the series. This faunal division might appropriately be called the zone of *Agasoma grvida*. Forms like *A. grvida* have a wide geographic range on this Coast and are apparently characteristic of the base of the Miocene.

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South of Contra Costa County the deposits in the middle Tertiary appear to take on quite a different character. Instead of a thin bed of sandstone below the Monterey shale, very considerable thicknesses of heavy sandstone and clay may form the basal beds. These may swell out to make a much more important stratigraphic unit than the basal sandstone of the Contra Costa region. In the Pacific Railroad survey reports, heavy fossiliferous sandstones are mentioned by Antisell\* as occurring at the base of the Miocene. Later, Whitney† presented sections of several regions where extensive Miocene sandstones lie below the shale. In the palaeontology of Whitney's report, Gabb‡ refers to the shale as the upper member of the Miocene, evidently having in mind the sandstones below it. In several of these references *Turritella ocoyana* is mentioned as a common form in these beds.

In 1895, Ashley§ described a thick series of sediments which he supposed to rest conformably below the Monterey. He listed several species from it, of which the most important and characteristic is *Turritella hoffmani*. Ashley was uncertain about the age of these beds, thinking they might be partly Eocene.

In 1896, Fairbanks,|| in his discussion of the geology of Point Sal, described extensive Miocene beds of clay and sandstone below the shale. Still more recently in his work on the San Luis Obispo Quadrangle he has carefully worked out the relation of this horizon to the shale and made extensive collections in it. These collections were turned over to the University of California. They were worked over by Mr. F. C. Calkins, who has found in them a very interesting fauna. *Turritella hoffmani* is perhaps the most characteristic species. Along with it are a great many forms not known in the later beds. Other collections made more recently by Dr. Ralph Arnold in the *T. hoffmani* beds described by Ashley show the same fauna as that collected by Fairbanks almost species for species.

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\*T. Antisell. Pacific R. R. Rep. Vol. 7, p. 197.

†J. D. Whitney. Geol. Surv. Calif. Vol. I, p. 128, fig. 10, and p. 135, fig. 17.

‡W. M. Gabb. Geol. Surv. Calif., Palaeontology. Vol. II, p. 59.

§G. H. Ashley. Leland Stanford Junior Publications. Geol. and Palaeont. No. 1, p. 291.

||H. W. Fairbanks. Bull. Dept. Geol. Univ. Calif. Vol. II, No. 1, p. 5.

Search has been made in this fauna for species like those of the lowest Miocene of Contra Costa County. So far there have been found an *Agasoma* very much like *gravida*, a *Dosinia* of the type of *matthewsoni* and a *Chione* of the type of *matthewsoni*. The *Dosinia* and *Chione* are not identical in form with the types but come near them. This fauna probably belongs to the *Agasoma* zone of the lower Miocene, and were it not for certain complications that arise it might be designated as such. For the present it may be called the zone of *Turritella hoffmani*.

The complications just mentioned are due to the fact that in many of the regions in the southern part of the state, where the sandstone phase of the Miocene is developed extensively below the shale, the fauna containing *T. hoffmani* is not discovered, but in its place there is found an abundance of *Turritella ocoyana* along with *T. variata*. In most of the localities only a few species have been found with those two forms, but enough has been seen to make it appear that this is not exactly the same zone as that of *T. hoffmani*. On the other hand, there is evidence enough to show that the two horizons are not far removed from each other. Near Bakersfield, in the beds from which the type of *T. ocoyana* was obtained, an extensive fauna has been discovered. Most prominent among the species are three forms of *Agasoma*, the most common of which is near *gravida*. In some respects it is intermediate between *A. gravida* of the lower Miocene and *A. sinuata* of the upper Miocene.

Both the zone of *T. hoffmani* and that of *T. ocoyana* appear to belong close to the *Agasoma* zone of Contra Costa County. It is also probable that the *T. hoffmani* zone is the older of the two, as its fauna is made up very largely of extinct forms. That of the *T. ocoyana* beds at Kern river contains a much larger number of recent species, it is generally more modern in its appearance, and it also shows the *Agasoma* group much more highly developed and much more common than in the *T. hoffmani* beds.

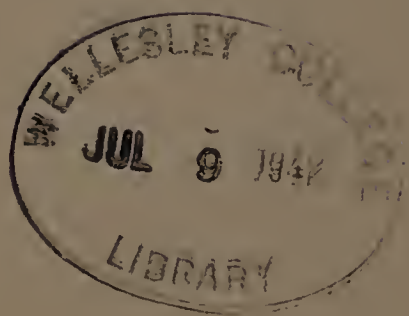
In the southern part of the state we probably have two fairly distinct zones of the lower Miocene. The question naturally arises; are we to consider the beds in Contra Costa County as the equivalent of one or both of these divisions? This much may be said, viz.: The fauna of the *Agasoma* beds of Contra Costa

County seems to contain a somewhat larger number of recent species than the *T. hoffmani* division and also lacks some of the extinct species which belong to it. That this is probably not simply a geographic variation in the fauna is shown by the proximity of the *T. hoffmani* beds of Ashley to the *Agasoma* beds of Contra Costa County.

When we come to study the subdivisions of the lower Miocene both palaeontologically and stratigraphically some interesting things relating to the movement of the Miocene shore lines are suggested. The *T. hoffmani* zone is found principally in the western or coast region. The *T. ocoyana* zone occurs in the western region and also to the east of the great valley, where the *T. hoffmani* is not yet known. It would therefore appear that the sea had not reached as far east in the earliest Miocene as it did later, and that the thick shale beds over the lower sands of the western region were formed while sandy *T. ocoyana* beds were being deposited to the east.

*University of California,*

*March, 1904.*







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